Notice of Allowability	Application No.	Applicant(s)	
	10/689,116	ANVARI, KIOMARS	
	Examiner	Art Unit	
	Quochien B. Vuong	2618	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *04/07/2006*.

2. ☒ The allowed claim(s) is/are *1-14 and 16 which have been renumbered to 1-15*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

2. Authorization for this examiner's amendment was given in a telephone interview with Applicant Mr. Kiomars Anvari on 06/07/2006.

3. The application has been amended as follows:

In the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) A wireless peak suppression and pre-distortion circuit for use with multi-carrier power amplifiers in a wireless communication system to enhance the linearity and performance of the amplifier, in [particular] wireless cellular, PCS, wireless LAN, line of sight microwave, military, [and] or satellite communication systems, the peak suppression and pre-distortion circuit comprising:

[. Two] two multi-carrier receivers one for the peak suppression and pre-distortion main IF or RF signal input and one for amplifier feedback input[. If] ; wherein when the main signal is baseband then the main multi-carrier receiver is bypassed[.] ;

[. A] a digital signal processing block to peak suppress and pre-distort the main multi-carrier input signal using lookup tables[.] ;

[. A] a digital signal processing block to use the main multi-carrier input signal and amplifier feedback multi-carrier input to adaptively update the pre-distortion lookup table. A digital signal processing block to use the input and the output of the peak suppression to produce the phase rotation lookup table[.] ;

[. A] a digital signal processing block to evaluate the delay between the main multi-carrier signal and the amplifier multi-carrier feedback signal and adjust the main signal delay before being used by the lookup table adaptation algorithm. The algorithm will continuously adjust the delay during the operation[.] ;

[. A] a digital signal processing block to evaluate the gain between the main multi-carrier signal and the amplifier multi-carrier feedback signal and adjust the both signal's gain before being used by the lookup table adaptation algorithm[. The] wherein the algorithm will continuously adjust the gain during the operation[.] ;

[. A] a digital signal processing block to accurately evaluate the delay between the main multi-carrier signal and the amplifier multi-carrier feedback signal by changing the coefficient of a decimation filter used in the path of amplifier feedback signal to produce T/k accuracy[.] ; and

[. A] a multi-carrier transmitter block that prepare the peak suppressed and pre-distorted main multi-carrier signal for delivery to multi-carrier power amplifier.

2. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein main multi-carrier input signal from the wireless transmitter is sampled using sub-harmonic sampling technique at the input frequency or at an intermediate frequency.

3. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein main multi-carrier input signal from the wireless transmitter is sampled using sub-harmonic sampling technique at the input frequency or at an intermediate frequency and the digitized main multi-carrier input signal is down converted digitally and decimated to the appropriate number of samples per symbol for further digital signal processing.

4. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein main multi-carrier input signal from the wireless transmitter is baseband and is sampled using Nyquist sampling technique and interpolated to produce the baseband multi-carrier signal with appropriate number of samples per symbol.

5. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein main input signals from the wireless transmitter are in bit domain and the bit domain baseband signals are up converted, combined and interpolated to produce the digital multi-carrier baseband signal with appropriate number of sample per symbol.

6. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein feedback multi-carrier input signal from the wireless multi-carrier power amplifier is sampled using sub-harmonic sampling technique at the input frequency or at an intermediate frequency.

7. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein feedback multi-carrier input signal from the wireless multi-carrier power amplifier is sampled using sub-harmonic sampling technique at the input frequency or at an intermediate frequency and the digitized feedback input signal is down converted

digitally and decimated to the appropriate number of samples per symbol for further digital signal processing.

8. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein the digital multi-carrier main baseband signal is converted to single channel baseband signals by digital down conversion. The individual baseband signals are phase rotated using the phase from phase rotation lookup table, then filtered and up converted back to their original baseband frequency before all individual baseband signals being combined again to produce the multi-carrier peak suppressed baseband signal.

9. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein the peak suppressed, and pre-distorted main signal using a lookup table is digitally up converted and converted to analog domain at an intermediate frequency or the output frequency.

10. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein the digitized main signal and feedback signal are used to adaptively update the pre-distortion lookup table, wherein the main signal samples are delayed to match the samples from the amplifier feedback input before being used by lookup table adaptation algorithm, wherein the man signal samples and the amplifier feedback signal samples are gain controlled before being used by the lookup table adaptation algorithm.

11. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein the peak suppression phase rotation lookup table is created using the input and the output from the peak suppression block during the calibration.

12. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein feedback input signal from the wireless power amplifier is sampled using sub-harmonic sampling technique at the input frequency or at an intermediate frequency and the digitized feedback input signal is down converted digitally, decimated down to the appropriate number of samples per symbol with a sampling phase to allow phase alignment (in T/k steps) with the main input signal for further digital signal processing by the adaptation algorithm.

13. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein main input signal and digitized feedback input signal are aligned in amplitude by automatic gain control operations prior to further processing by the lookup table adaptive algorithm which updates the pre-distortion lookup table.

14. (Original) The peak suppression and pre-distortion circuit according to claim 1, wherein the delay described in claim 1 is measured by initially generating a digital signal with high autocorrelation property, such as a pseudo random sequence used by the main signal path, and correlation of this sequence with the amplifier output feedback signal by delay adjustment algorithm. The correlation window is incremented by adjusting the sampling phase in decimation block in the path of the amplifier output feedback signal in T/k steps by changing the coefficients of the decimation filter in the amplifier output feedback signal path, and by incrementing the delay of main input signal used by the delay adjustment algorithm by integer sample unit delays.

15. (Canceled)

16. (Currently Amended) The peak suppression and pre-distortion circuit according to claim 1, wherein the [DSP1 and DSP2] digital signal processing block can be implemented in programmable logic, FPGA, Gate Array, ASIC, and DSP processor.

Reasons for Allowance

4. The examiner's amendment above is needed to correct the claim identifiers and amendment format in order to put the case in condition for allowance.

5. Claims 1-14 and 16 are allowed over the cited prior art.

6. The following is an examiner's statement of reasons for allowance:

Regarding independent claim 1, Ring (US 6,750,710) disclose a wireless peak suppression and pre-distortion circuit (figures 2 and 3) for use with multi-carrier power amplifiers in a wireless communication system to enhance the linearity and performance of the amplifier, in wireless cellular, PCS, wireless LAN, line of sight microwave, military, or satellite communication systems, the peak suppression and pre-distortion circuit comprising: multi-carrier receiver and a phase look-up table (column 2, line 50 – column 3, line 57). However, Ring and the cited prior art fail to teach or fairly suggest the wireless peak suppression and pre-distortion circuit above further comprising two multi-carrier receivers, digital signal processing blocks, a multi-carrier transmitter block , and their functions as recited in the claim.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kim et al. (US 5,877,653) disclose linear power amplifier and method for removing intermodulation distortion with predistortion system and feed forward system.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Quochien B. Vuong whose telephone number is (571) 272-7902. The examiner can normally be reached on M-F 9:30-18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Urban can be reached on (571) 272-7899. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Quochien B. Vuong
June 07, 2006.

QUOCHIEN B. VUONG
PRIMARY EXAMINER